

CURRICULUM VITAE

Luther Beegle

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Education

University of Alabama at Birmingham	Ph.D.	1997	Astrophysics
<i>A Model of the Complex Hydrocarbon Component of the Interstellar Medium: Observational and Experimental Considerations</i>			
University of Alabama at Birmingham	MS	1995	Physics
University of Delaware	BS	1990	Physics/Astronomy

Present Position:

2016-present: Deputy Division Manager, Science.

2014-present: Principal Investigator, SHERLOC.

2015-present: Principal Scientist, Jet Propulsion Laboratory. Responsibilities include conducting NASA funded research as a PI and Co-I in planetary science focusing on detection and characterization of organic molecules for the identification of potential biosignatures.

Past Positions:

2013-2016: Deputy Section Manager, Planetary Science Section, Science Division at JPL.

- Supervised a section of ~80-100 Ph.D. scientists

2009-2018: Surface Sampling System Scientist MSL SASHaP system. Supported the development of the hardware testbeds and identified samples for ambient testing until MSL landed. Participation in scientific operations focusing on properties of surface material and the acquisition and processing of samples in Gale Crater.

2003-2015: Research Scientist, Jet Propulsion Laboratory, California Institute of Technology, Pasadena California. Responsibilities include conducting NASA funded research as a PI and Co-I in planetary science focusing on detection of organic molecules off in situ platforms.

2005-2013: Group Supervisor Group 3225, Planetary Chemistry and Astrobiology group, Science Research Division, Jet Propulsion Laboratory, California Institute of Technology.

- Supervised a research group of 8 to 15 Ph.D. scientists

2001-2003: Scientist, Jet Propulsion Laboratory, California Institute of Technology, Pasadena California. Conducted NASA funded research as a PI and Co-I on the collection, extraction, detection and identification of organic molecules as part of a future *in situ* rover platform.

1999- 2001: Postdoctoral Scholar, California Institute of Technology, Pasadena California. Developing analytical instrumentation techniques for the *in-situ* search for organic molecules. Conducted astrobiological experiments to help elucidate conditions organic molecules might face on extraterrestrial planets.

1997- 1999: National Research Council Post-Doctoral Scholar, Jet Propulsion Laboratory, California Institute of Technology, Pasadena California. Performed first ever

- temperature dependent absorption spectroscopy of atmospheric species.
Performed electron impact studies on the atmospheric species of CO and SO₂.
- 1996: Instructor, PHS110, An Overview of Space Exploration, The University of Alabama at Birmingham.
- 1993-1997: Research Assistant, The University of Alabama at Birmingham, under NASA programs: Origins of Solar Systems, Exobiology, UV Astronomy, and IR Astronomy. Investigated interstellar molecules and ions which make up the interstellar medium and are responsible for several Astronomical features including the 2175 Å bump, Unidentified Infrared bands, and Diffuse Interstellar Bands (UV Astronomy, IR Astronomy and Origins of Solar Systems). Additional investigations included work on the miniaturization of a laser Raman spectrometer (PIDDP), and identification of carbonaceous material in ancient terrestrial rock samples as Martian Analogs (Exobiology).
- 1991-1993: Teaching Assistant, The University of Alabama at Birmingham. Taught Classical Mechanics laboratory for majors and non-majors, Thermodynamics for majors, Electricity and Magnetism for majors, and Modern Physics for majors.

Funded Proposals:

Scanning Habitable Environments with Luminescence and Raman for Organics and Chemistry: SHERLOC. An investigation on Mars 2020 to launch August 2020.

Principal Investigator in 9 different proposals funded under three different NASA programs PIDDP, ASTID.

Co-Investigator on 19 peer-reviewed proposals which were funded under 7 different NASA programs: ASTEP, MIDP, PIDDP, ASTID, Vision Missions, Origins of Solar Systems, Exobiology and UV/VIS Astrophysics.

Funded Proposals (Task Manager Co-I):

Advanced Robotic Detection of Chemical/Biological Agents, Toxic Industrial Gases and IEDS for Force Health Protection PHASE II SBIR from the Army. Small Business point of contact: IonFinity, LLC. 2.5 years, \$225K. 2008

Miniature Electric Sniffer for Navy Vertical Take-Off Unmanned Aerial Vehicle (VTUAVS) SBIR from the Army. Small Business point of contact: IonFinity, LLC. 2 years, \$225K. 2008.

Professional Activities:

- Editor, *Astrobiology* Journal
- Member of a multi-center ad hoc committee (*Keeping the candle lit*) for future human exploration of Mars (2010-2013).
- Member of the American Association for the Advancement of Science, the International Society of Ion Mobility Spectroscopy, the American Geophysical Union, and the American Chemical Society.
- Member of the Astrobiology Science Steering Group to define Astrobiological objectives for future Mars missions (2004)
- Member of the Mars Human Precursor Science Steering group defining risks and measurements needed for human exploration of Mars (2005)
- Worked with the University of Alabama at Birmingham's Media Relations department as science expert for local interviews with television stations and newspapers.
- Worked with education outreach at University of Alabama at Birmingham as guest lecturer at local schools (elementary, middle and high).
- Judge for the Alabama Science Olympiad (1995, 1996, 1997).

- Reviewer for Planetary and Space Science, Astrobiology, Icarus, Earth and Planetary Science Letters, Journal of Geophysical Research and Analytical Chemistry
- Reviewer for NASA Mars Fundamental Research Program (2005)
- Organized topical sessions for The Geological Society of America Annual Meeting, Lunar and Planetary Science Conference, and the American Geophysical Union Fall meetings.

Mentor:

Post Doctoral Mentor for: Joseph Razzell Hollis, Brandi Carrier, Hugh Kim, Everett Salas, and DeLing Liu.

Abbreviated List of Summer Interns: Hanieh Amoozegar, Brett Beckett, Alexa Raquel Bilek, Andrew Carnes, Juliana Capri, Nathan Figlewski, Kristina Goltz, Benjamin Hall, Samuel Long, Hugh Kim, Ernest Ryu, Alison Saltzman, Shakher Sijapati, Santosh Soparawalla, Meagan Spencer, Saman Halabian

Patents:

- Proton-Transfer Reaction/Ion Mobility Spectrometer. Developed a novel high-pressure hollow cathode ionizer for use in ambient Martian environments. Patent number: 6,794,645 B2, 21 September 2004.
- Development of an automated de-salting apparatus. NPO 45428
- Non-Contact Conductivity Measurement for Automated Sample Processing Systems. Provisional Patent CIT-5831-P.

Publications:

SHERLOC:

Detection and Degradation of Adenosine Monophosphate in Perchlorate-Spiked Martian Regolith Analogue, by Deep-Ultraviolet Spectroscopy in Astrobiology

Mars 2020 Mission Overview in Space Science Reviews

An Optical Model for Quantitative Raman Micro-Spectroscopy in Applied Spectroscopy.

Attenuation of ultraviolet radiation in rocks and minerals: Implications for Mars Science in Journal of Geophysical Research: Planets

WATSON: In Situ Organic Detection in Subsurface Ice Using Deep-UV Fluorescence Spectroscopy in Astrobiology

Deep UV Raman spectroscopy for planetary exploration: The search for in situ organics in Icarus

Mars Science Laboratory:

A look back, part II: The drilling campaign of the Curiosity rover during the Mars Science Laboratory's second and third martian years. Icarus Deep-ultraviolet Raman spectra of Mars-relevant evaporite minerals under 248.6 nm excitation in Icarus

A Look Back: The Drilling Campaign of the Curiosity Rover during the Mars Science Laboratory's Prime Mission in Icarus

Uniaxial compressive strengths of rocks drilled at Gale crater, Mars in Geophysical Research Letters

ChemCam investigation of the John Klein and Cumberland drill holes and tailings, Gale crater, Mars in Icarus

A Habitable Fluvio-Lacustrine Environment at Yellowknife Bay, Gale Crater, Mars. Science

In Situ Radiometric and Exposure Age Dating of the Martian Surface in Science

MAHLI at the Rocknest sand shadow: Science and science-enabling activities in Journal of Geophysical Research-Planets

Collecting Powdered Samples in Gale Crater, Mars; An Overview of the Mars Science Laboratory Sample Acquisition, Sample Processing and Handling System in Space Science Reviews

Instrument/Mission Development:

X-Ray Emission from Jupiter's Galilean Moons: A Tool for Determining Their Surface Composition and Particle Environment in *Astrophysical Journal*

Effects of Hypervelocity Impact of Molecules from Enceladus' Plume and Titan's Upper Atmosphere on NASA's Cassini Spectrometer from Reactive Dynamics Simulations in *Physical Review Letters*

LIFE: Life Investigation for Enceladus: A Sample Return Mission Concept in Search for Evidence of Life in *Astrobiology*

Miniature Mass Spectrometer Equipped with Electrospray and Desorption Electrospray Ionization for Direct Analysis of Organics from Solids and Solutions. in *International Journal of Mass Spectrometry*

Particle Sieving and Sorting Under Simulated Martian Conditions in *Icarus*

Particle Transport and Distribution on the Mars Science Laboratory Mission: Effects of Triboelectric charging in *Icarus*

Mojave Mars Simulant – a New Approach to Martian Soil Simulants in *Icarus*

RASP Based Sample Acquisition of Analogue Martian Permafrost Samples: Implications for NASA's Phoenix Scout Mission in *Planetary and Space Science*

Ion mobility spectrometry in space exploration in *International Journal of Mass Spectrometry*

Chemistry

Time Resolved Studies of Interfacial Reactions of Ozone with Pulmonary Phospholipid Surfactants Using Field Induced Droplet Ionization Mass Spectrometry in *Journal of Physical Chemistry B*

Interfacial Reactions of Ozone with Surfactant Protein B in a Model Lung Surfactant System in *Journal of the American Chemical Society*

Structural Characterization of Phospholipids Using Traveling Wave Ion Mobility Spectrometry in N_2 in *Analytical Chemistry*

An Experimental and Theoretical Investigation into the Correlation between Mass and Ion Mobility for Choline and Other Ammonium Cations in N_2 in *Analytical Chemistry*

Electrospray Ionization Ion Mobility Spectrometry of Carboxylate Anions: Ion Mobilities and a Mass-Mobility Correlation in *Journal of Physical Chemistry A*

Effects of Drift-Gas Polarizability on Glycine Peptides in Ion Mobility Spectrometry in *International Journal of Mass Spectrometry*

Investigation of Drift Gas Selectivity in High Resolution Ion Mobility Spectrometry with Mass Spectrometry Detection in *Journal of the American Society for Mass Spectrometry*

Electrospray Ionization High-Resolution Ion Mobility Spectrometry for the Detection of Organic Compounds, 1. Amino acids in *Analytical Chemistry*

Astrobiology

A concept for NASA's Mars 2016 Astrobiology Field Laboratory. Astrobiology The Cell and the Sum of Its Parts: Patterns of Complexity in Biosignatures as Revealed by Deep UV Raman Spectroscopy. *Frontiers in Microbiology* in

The Mojave Vadose Zone: A Subsurface Biosphere Analog for Mars in *Astrobiology*

Analysis of Underivatized Amino Acids of Geological Interest using Ion-Pairing Liquid Chromatography/Electrospray Ionization/Tandem Mass Spectrometry in *Astrobiology*

Astrophysics

Laboratory Investigation of the Contribution of Complex Aromatic/Aliphatic Polycyclic Hybrid Molecular Structures to Interstellar Ultraviolet Extinction and Infrared Emission in *Astrophysical Journal*

Hydrogenation of Polycyclic Aromatic Hydrocarbons as a Factor Affecting the Cosmic 6.2 Micron Emission Band in *Spectrochimica Acta Part a-Molecular and Biomolecular Spectroscopy*

Experimental Indication of a Naphthalene-Base Molecular Aggregate for the Carrier of the 2175 Angstrom Interstellar Extinction Feature in *Astrophysical Journal Letters*

A Laboratory Analog for the Carrier of the 3 Micron Emission of the Protoplanetary Nebula IRAS 05341+0852 in *Astrophysical Journal*

Plasma Processing of Interstellar PAHs into Solar-System Kerogen in *Planetary and Space Science*

Inference of a 7.75 eV Lower Limit in the Ultraviolet Pumping of Interstellar Polycyclic Aromatic Hydrocarbon Cations with Resulting Unidentified Infrared Emissions in *Astrophysical Journal*

Spectroscopy of PAH Species in the Gas-Phase in *Planetary and Space Science*

Aeronomy

Middle Ultraviolet and Visible Spectrum of SO₂ by Electron Impact in *Journal of Geophysical Research-Space Physics*

High Resolution Emission Spectroscopy of the A (1)Pi-X (1)Sigma(+) Fourth Positive Band System of CO Excited by Electron Impact in *Astronomy and Astrophysics*

Electron-Impact Excitation/Emission and Photoabsorption Cross Sections Important in the Terrestrial Airglow and Auroral Analysis of Rocket and Satellite Observations in *Physics and Chemistry of the Earth Part C-Solar-Terrestrial and Planetary Science*

Temperature-Dependent photoabsorption Cross Section Measurements of O-2 at the NI Airglow and Auroral Emission Lines in *Chemical Physics Letters*

Full vitae, including publications, available upon request